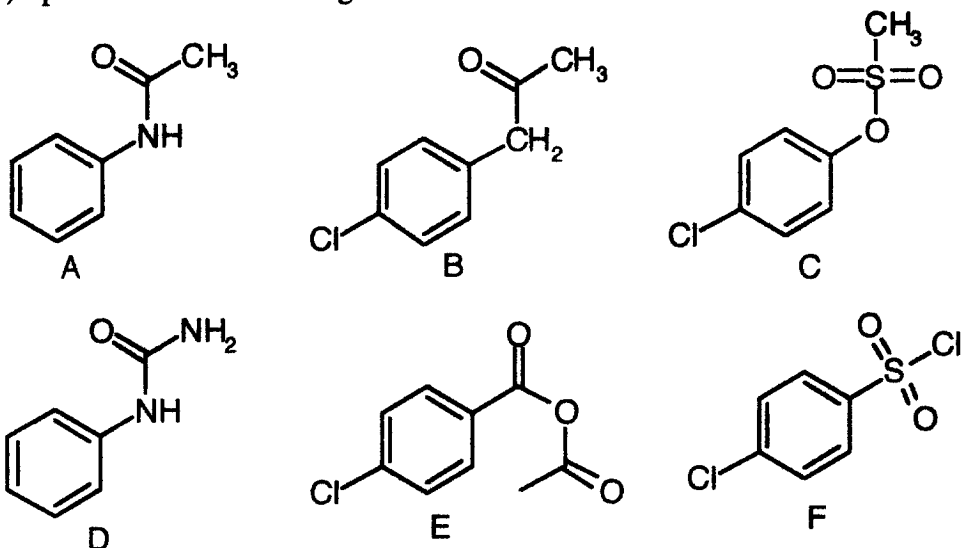


Name KEY
Chem 227/ Dr. Rusay/ Exam 3

1) 3pts. Name the product formed from the reaction of acetyl chloride with p-nitrophenol.

p-nitrophenyl acetate

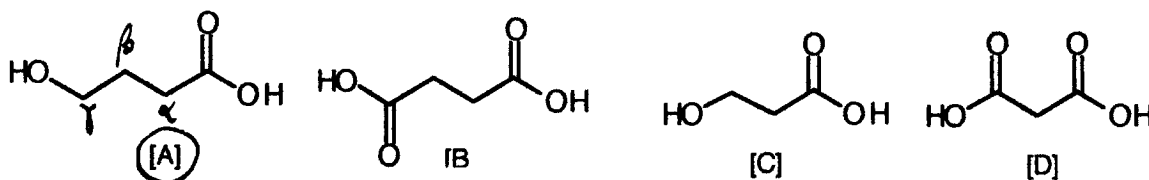
2) 4pts. Match the following structures and functions.



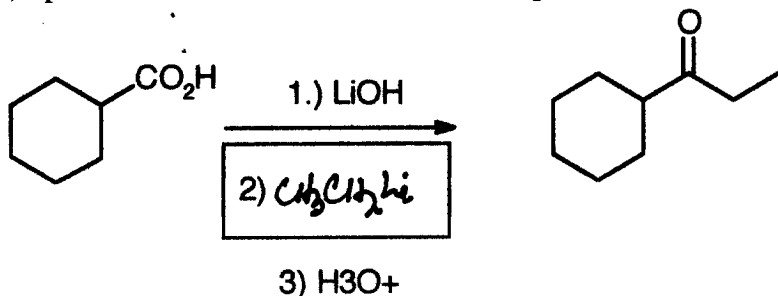
urea
ester
anhydride
acid chloride

D
C
E
F

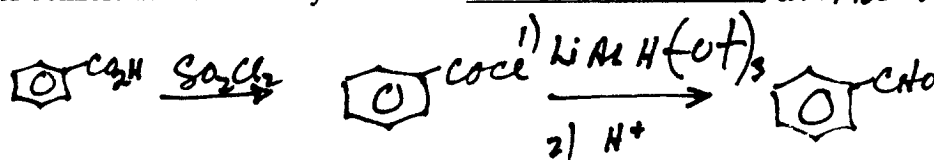
3) 3pts. Circle the compound or compounds that can form a gamma lactone.



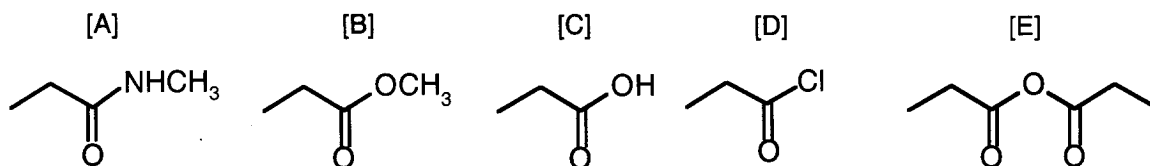
4) 3pts. Provide the correct reactant for step 2).



5) 3pts. What reagent (name or formula) can be used to produce benzaldehyde starting with the product of the reaction of benzoic acid and thionyl chloride? Lithium tri-tert-butoxy aluminum hydride

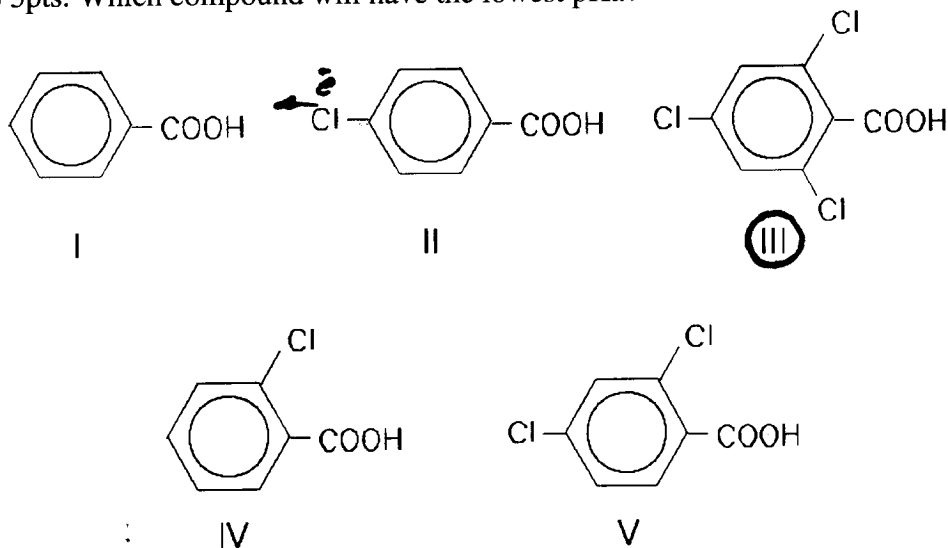


6) [4pts] Rank the following compounds in order from highest reactivity to the lowest when each of the compounds is reacted with ethanol which is acting as a nucleophile.

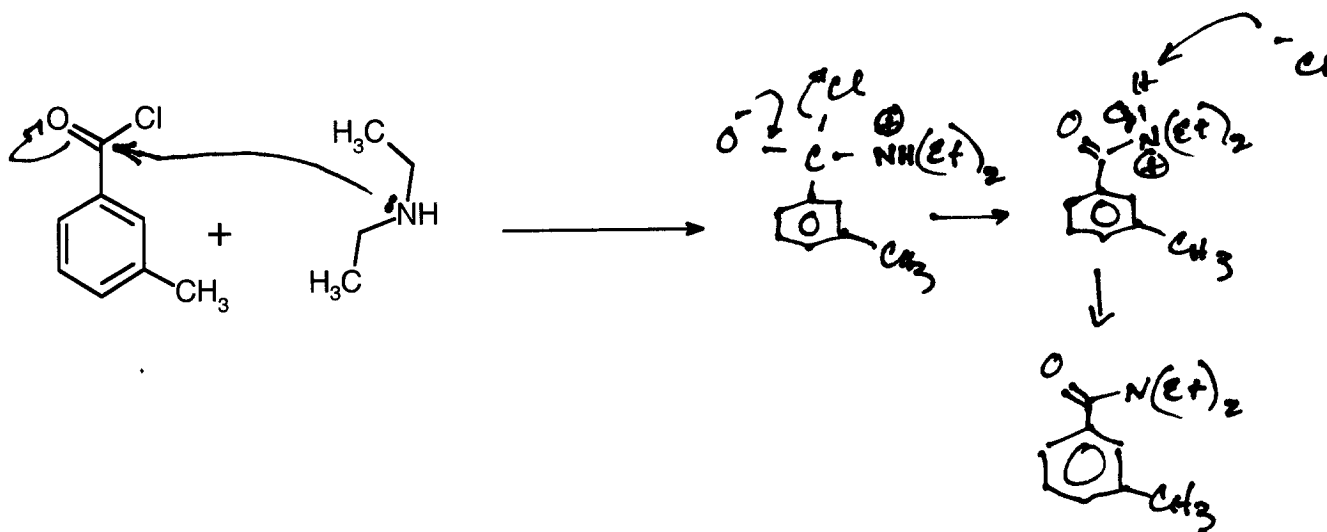


D > E > B > A > C

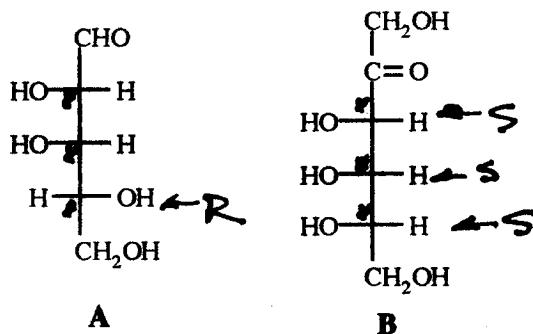
7) 3pts. Which compound will have the lowest pKa?



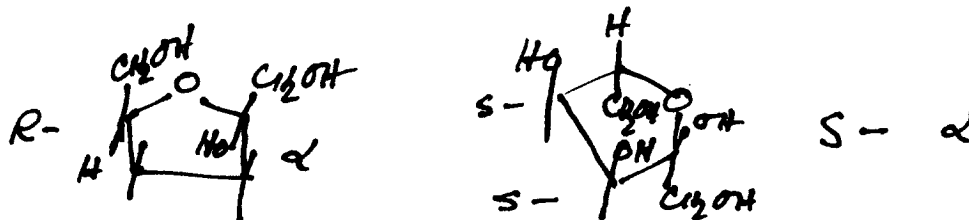
8) [8pts] Show a complete mechanism for the formation of Deet:



9) 8pts. For the following saccharides:



- a) How many chiral carbon atoms are there in **A** 3 and **B** 3 ?
- b) Identify the absolute configuration (D- or L-) for the ketose L and the aldose D.
- c) How many stereoisomers are possible for the ketose? $2^3 = 8$
- d) Draw the Haworth formula for the alpha-furanose of **B**:

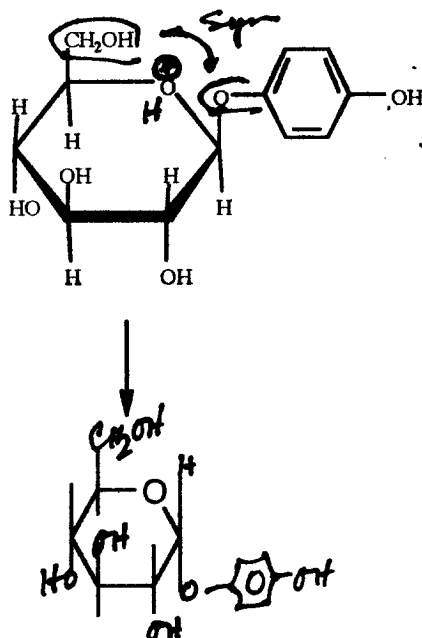


- e) Which compound(s) will produce a positive Tollen's test? Both or A

10) 4pts. For the following glycoside, arbutin:

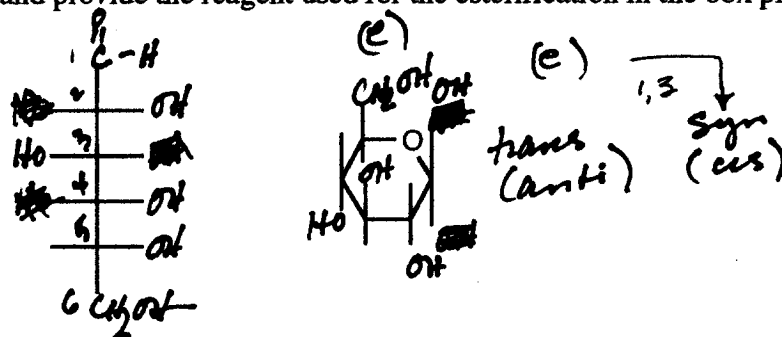
- a) Is this anomer alpha or beta? β Circle the structural features that support your selection.

b) Draw the other epimer, which forms from acid hydrolysis of arbutin and show which oxygen atom is protonated in the mechanism and how the ring opens with an arrow showing the direction of electron movement.

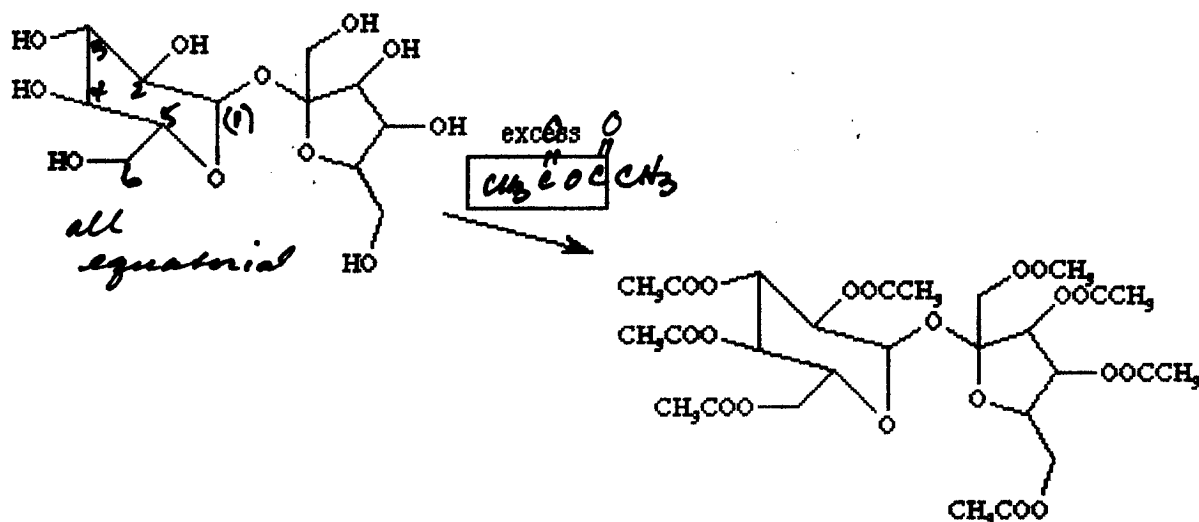


11) 6pts. The commercialization of Olestra (Olean) came about from the study of several different saccharides. Process studies likely involved the formation of the Olestra disaccharide from a ketose and an aldose followed by esterification which is illustrated in the following reaction.

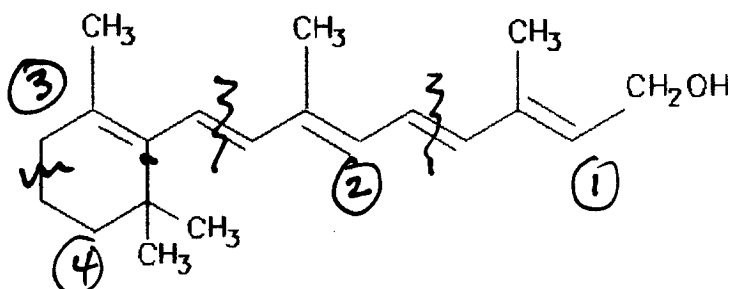
Using the following skeletons draw Haworth and Fischer structures for the aldose which was used to produce the disaccharide and provide the reagent used for the esterification in the box provided.



aldose + ketose \rightarrow



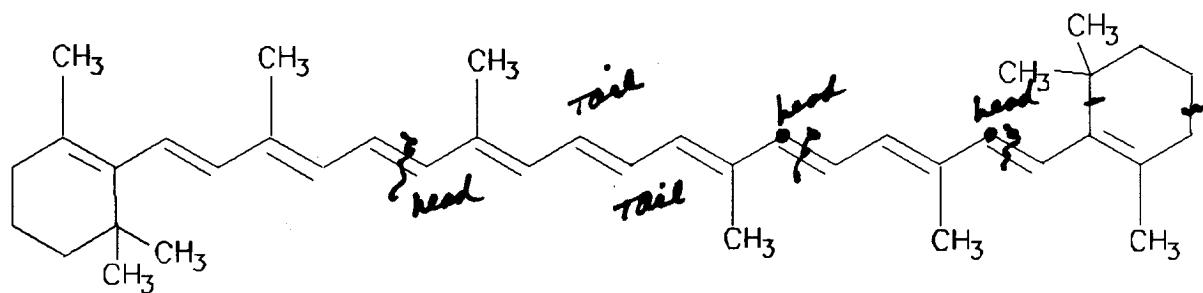
12) 4pts. A) How many isoprene units are there in Vitamin-A? 4



B) Circle each of the individual isoprene units in the structure.

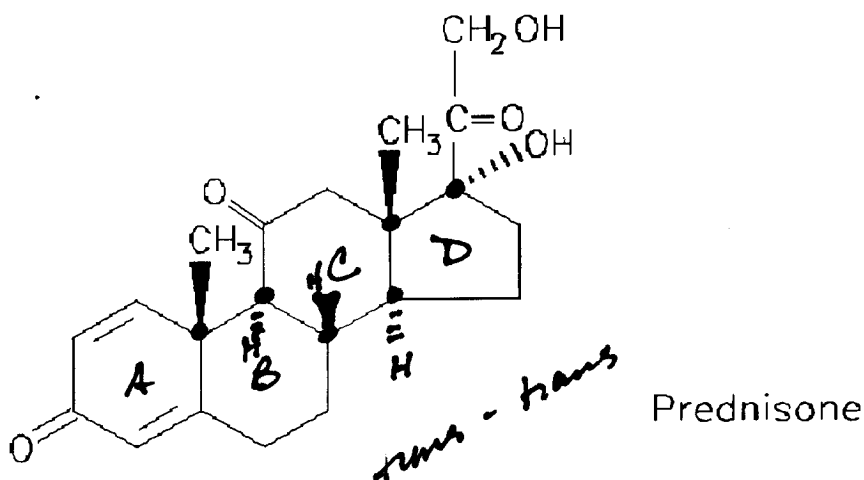
C) True / False: Vitamin A is a sesquiterpene. F

13) 4pts. Carotenoids are structurally related to Vitamin A. Below is a structure of a carotenoid found in carrots and tomatoes.



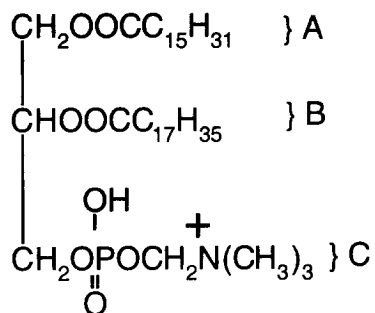
How many tail to tail isoprene linkages are there in the molecule? 1 Circle the one(s) that you identify. (Hint: in Vitamin A all the linkages are head to tail.)

14) 4pts. **Label** the A, B, C and D rings in the following steroid, prednisone, which is used as an anti-inflammatory drug. Steroids can generally be cis or trans at the fusion of the A and B rings. However, fusion at the B and C rings is almost always one form. **Draw** in the hydrogens to clearly indicate this form; i.e. whether the fusion is cis- or trans.



How many chiral carbon atoms (stereocenters) are there in prednisone? 6.

15) 3pts. Phosphatidyl choline is highly important to micelles due to its dual hydrophobic and hydrophilic properties. Identify which portion(s) (A,B,C) of the molecule account for the different properties.



Hydrophilic: C Hydrophobic: A, B

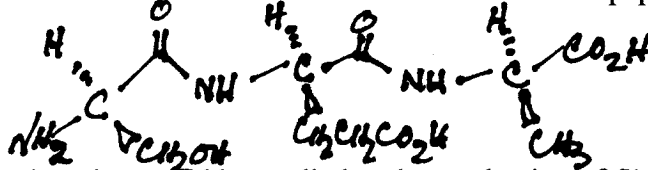
16) 6pts. Several fermentation experiments leading to the fat substitute *Simplesse* centered on polypeptides of 3 amino acids: alanine, serine and glutamic acid (R = -CH₃; -CH₂OH; and -CH₂CH₂CO₂H respectively). Identify each amino acid by one type of characteristic in each of the three categories: I) polar or non-polar; II) acidic or basic or neutral; III) hydrophilic or hydrophobic

alanine: I) non polar II) neutral III) hydrophobic

serine: I) polar II) neutral III) hydrophilic/hydrophobic

glutamate: I) polar II) acidic III) hydrophilic

One experiment produced a tripeptide which had the following sequence Ser·Glu·Ala
Draw a complete stereochemical structure of the all R-isomer of the peptide:



17) 4pts. Genetic engineering could be applied to the production of *Simplesse*. What DNA sequence could be targeted to code for the following amino acid sequence. (Don't forget instructions to start and stop.) Ser·Glu·Ala·Ser·Thr

TAC
 n methionine
 { AGA GTC CGA AQA TGT } ATT
 AGC GTT CAG AGC TGA } ACA
 TGT CGT AGT TGG
 TGG CCG AGG TGC

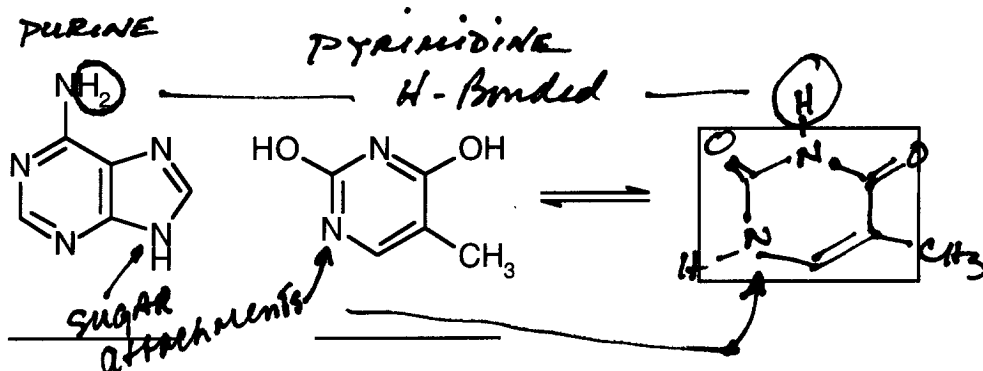
18) 3pts. Identify the major structural difference between a ribonucleoside and a ribonucleotide other than having different bases.

The ribonucleoside has a sugar and a base.
 The ribonucleotide has a sugar, base and phosphate.

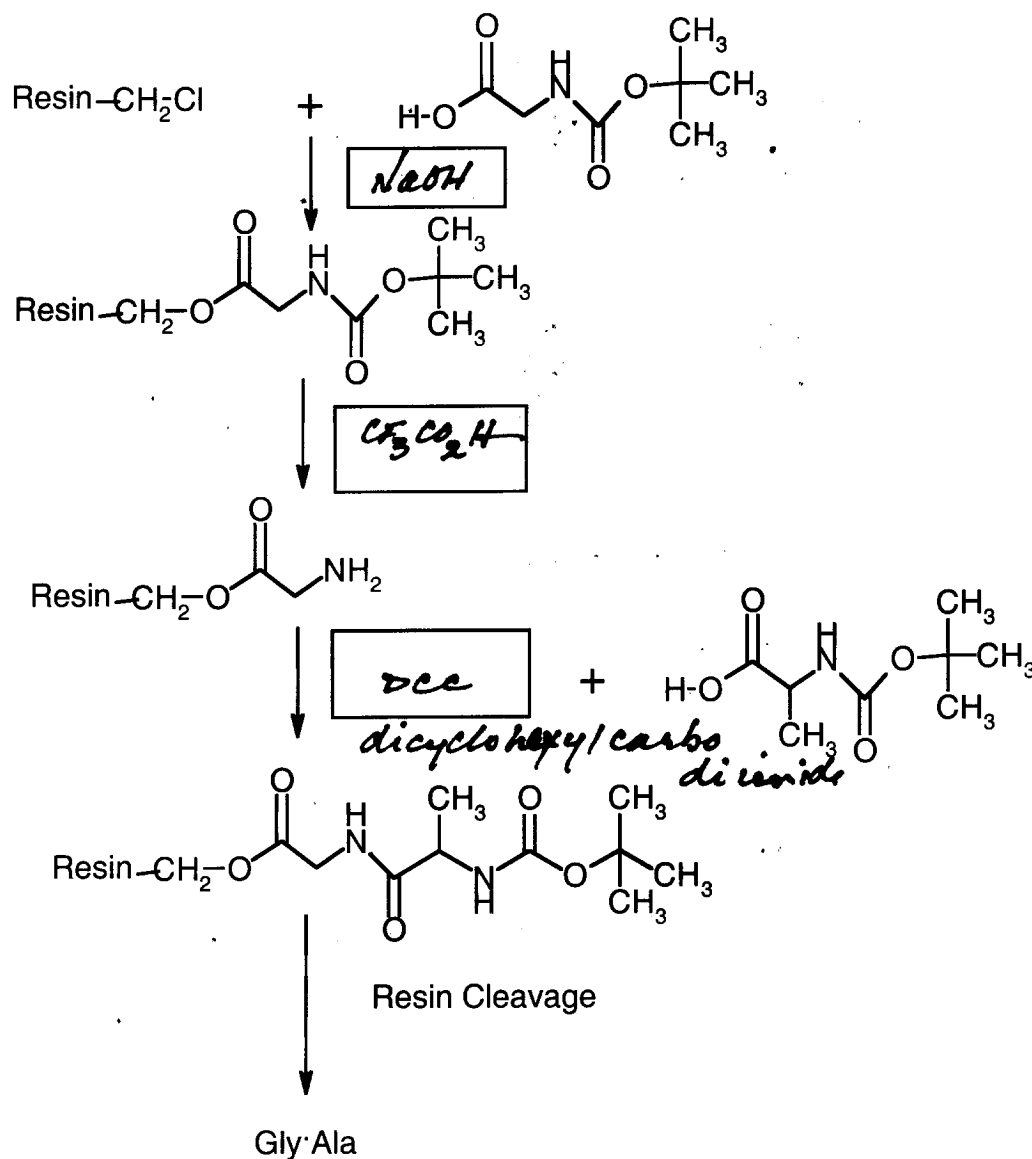
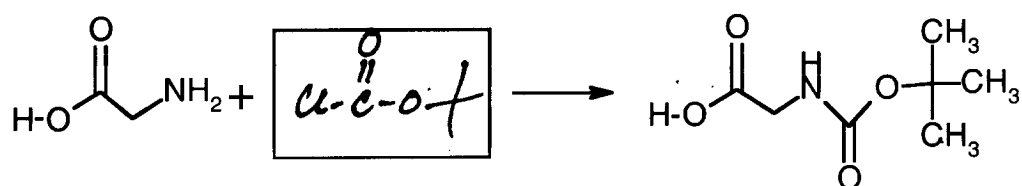
19) 3pts. What are the differences in the bases and structural components of DNA and RNA.

	<u>DNA</u>	<u>RNA</u>
Bases	A, G, C, T	A, G, C, U
Strand	DOUBLE STRAND	SINGLE STRAND
Sugars	DEOXYRIBOSE	RIBOSE

20) 6pts. Adenine and Thymine are shown. A) Identify which is the purine and which is the pyrimidine. B) Redraw Thymine in its keto tautomeric form. Circle the hydrogen atoms in both bases which hydrogen bond in DNA.



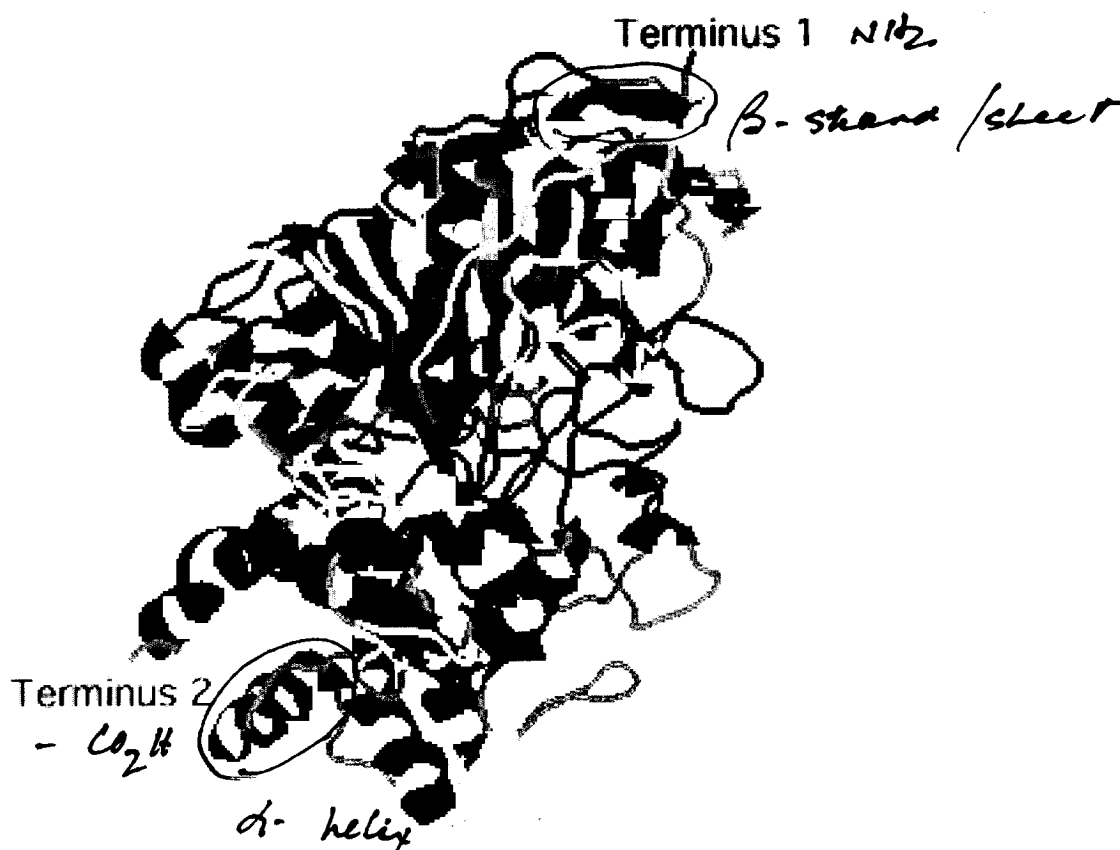
21) 8pts. Provide reagents for the reactions in the following Merrifield dipeptide synthesis.



22) 6pts. The following is a rendering of acetylcholinesterase in cartoon format. Circle and label: a beta sheet and an alpha helix. What level of structural features do they relate to?

1° or 2° or 3° or 4°

The two termini (ends) are labeled. Identify one as $-\text{NH}_2$ and the other as $-\text{CO}_2\text{H}$. Remember: the primary protein structure reads from left to right and the cartoon has arrows indicating direction of the chain in relation to this convention.



Extra Credit: 5pts.

Acetylcholinesterase is a serine protease which catalyses the hydrolysis of acetylcholine. An illustration on the following page shows the active site and the first step in the mechanism. Complete the mechanism beneath the illustration including step 1.